THE KANSAS UNIVERSITY SCIENCE BULLETIN

VOL. X, No. 13, JANUARY, 1917.

(Whole Series, Vol. XX, No. 13.)

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CHROMOSOMES OF NOMOTETTIX . . . . . *Myrtle F. Rayburn.*

PUBLISHED BY THE UNIVERSITY,

LAWRENCE, KAN.

Entered at the post office in Lawrence as second-class matter.

7-111

KANSAS STATE PRINTING PLANT.
W. R. SMITH, State Printer.
TOPEKA, 1917.

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VOL. X, NO. 13.] JANUARY, 1917. [WHOLE SERIES VOL. XX, NO. 13.

The Chromosomes of *Nomotettix*.

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THE Tettigidæ are a small, clearly defined group of grasshoppers known as the "grouse locusts." *Nomotettix* is one of the twenty-one genera comprising the members of this family found in North America. Of these, the cromosomes of representative species from four different genera, *Choriphyllum, Acridium, Paratettix* and *Tettigidea,* have been studied by Robertson ('15 and '16) and Harman ('15). *Nomotettix* will be the fifth genus to be added to this series.

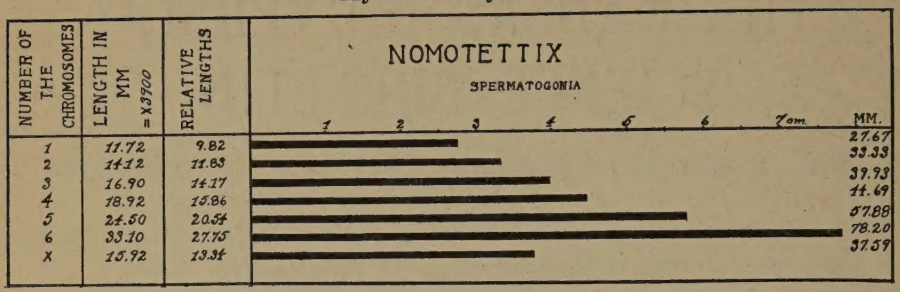
In his comparative study of the chromosomes of Tettigidæ, Robertson found a uniformity of numbers, and to a great extent of size relations throughout nine species belonging to the four genera above mentioned. In the species of *Nomotettix, cristatus* Scudder, which I have here studied, I find the same chromosome numbers and practically the same lengths of chromosomes.

The individuals used were from material collected near Lowell, Mass. The testes were fixed in Flemming's fluid and stained in Haidenhain's iron-hemotoxylin. Drawings were made with a camera lucida, and are here reproduced at a magnification of 2600 diameters.

The chromosomes of *Nomotettix* are of the rod-shaped type and are thirteen in number in the spermatogonia of the male. They may be readily arranged in a series of six pairs besides the accessory. There are two large pairs (Nos. 6 and 5), two intermediate pairs (4 and 3), and two smaller pairs (2 and 1). Usually the sex chromosome shows a woolly appearance, making it easy to distinguish. Its size is third in the series, coming between the 2's and 3's (autosomes).

CHROMOSOMES OF NOMOTETTIX.

Myrtle F. Rayburn.



In the table for *Nomotettix cristatus* Scudder, the first six horizontal bars represent the relative lengths of the six pairs of autosomes, and the seventh the percentage that the sex chromosome is of the total sum of the lengths of the autosomes.

In the relative lengths of chromosomes, the genus *Nomotettix* is more nearly like the genus Acridium than *Paratettix* or *Tettigidea,* as shown in particular by the measurements for the fifth and sixth pairs of chromosomes. Compare the relative lengths of these, 20.54 to 27.75, for the spermatogonia of *Nomotettix,* with those for the same chromosomes in *Acridium,* the genus to which *Nomotettix* is most nearly related taxonomically. Again, compare the relative lengths of the smallest and intermediate pairs with those of *Acridium.* It will be seen that there is not so very much difference. The smallest pairs, whose lengths are 9.82 and 11.83, compare very similar to the lengths 10.48 and 11.49 for *Acridium granelatus* or 11 and 11.06 for *A. incurvatus.* The intermediate pairs, 14.17 and 15.86, are slightly larger than in *Acridium,* the species *ornatus* excepted. These numbers in *Acridium* are as follows: For *granulatus,* 13.31 and 14.08; for *incurvatus,* 13.4 and 14.3; for *obscurus,* 13.3 and 14.1; but for *ornatus* 14.63 and 15.86.

The difference in length between the longer of the intermediate pairs and the shorter of the two longest pairs is about one-half as great as in the species of *Acridium.* Compare the ratio 15.86 to 20.54 of *Nomotettix* with 14.08 to 22.48 of *A. granulatus,* 14.3 to 22.5 of *A. incurvatus,* 15.86 to 21.47 of *A. ornatus* and 14.1 to 22.1 of *A. obscurus.* This is one point at which there is a rather marked disagreement between *Nomotettix* and *Acridium.*

In comparing the relative lengths of these chromosomes, as shown by the tables of my text figure, with those of Robertson for *Paratettix* and *Acridium,* it may at once be seen that

Nomotettix is farther away from *Paratettix* than from *Acridium*. For instance, there is a much less extreme range of length shown in *Paratettix* than in *Nomotettix*. Compare the ratios 9.82 to 27.75, the relative lengths of Nos. 1 and 6 of *Nomotettix*, with 11.4 to 23.6 and 11.4 to 23.7 of *Paratettix cucculatus* and *texana*, respectively, and also with 10.48 to 28.14 and 10 to 29.4 of *Acridium granulatus* and *obscurus*, respectively.

Likewise, the sex chromosome in *Nomotettix* is relatively shorter than in the species of *Paratettix*. Here it ranks between the second and third autosomes in spermatogonia, having the value of 13.34. In the spermatogonia of *Paratettix* it ranks between the second and third autosomes, but has the value of 13.9. In the first spermatocytes its rank is between the fourth and fifth autosomes and has a value of 17.2 in *Paratettix cucculatus* and 17.8 in P. *texana*. In *Acridium* it ranks either between the second and third autosome or below the first autosome. Its length is very short, having the value of either 11.95 or 8.7 in spermatogonia, or for first spermatocyte 13.45 (ranking between second and third, but low), 11 (ranking with No. 1), 7.9 (ranking below No. 1), and 12.09 (ranking between 2 and 3). It will be seen that in so far as size of the sex chromosome is concerned, *Nomotettix* is nearer to *Acridium* than to *Paratettix*.

As regards relations with the genus *Tettigidea*, *Nomotettix* is about the same distance away as *Acridium*. In this genus the two long chromosomes are relatively not so long, 22.3 and 24.6, and are more nearly equal in length, while in *Nomotettix* they are very unequal in length, as in Acridium. The sex chromosome in *Tettigidea* ranks fifth in the series, while in *Nomotettix*, as already mentioned, it ranks third.

CONCLUSIONS.

1. *Nomotettix* agrees with all other genera of the family Tettigidæ in having in the male six pairs of autosomes and one sex chromosome.

2. It agrees with those genera of the family so far examined in that the pairs of autosomes readily arrange themselves according to length into three groups—two shorts, two intermediates, and two longs.

3. In the relative lengths of the autosomes this species of *Nomotettix* agrees more readly with species of *Acridium* than

with species of *Paratettix*. This is to be expected, since externally the body characters of *Nomotettix* are more nearly like those of *Acridium* than of *Paratettix*. Likewise, this species of *Nomotettix* is much farther away from those of *Tettigidea* than from those of either *Acridium* or *Paratettix*. Again, this is to be expected from the fact that *Tettigidea* belongs to an entirely different subfamily, the Batrachidinæ. *Nomotettix*, *Acridium* and *Paratettix* belong to the subfamily Tettiginæ.

4. The sex chromosome may be recognized in spermatogonial divisions by its woolly appearance.

5. The chromosomes of *Nomotettix*, when compared as to numbers, relative sizes, etc., with those of other genera of Tettigidæ, furnish evidence decidedly in favor of the hypothesis that chromosomes are individual self-perpetuating elements.

This work was done under the direction of W. R. B. Robertson.

JUNE 1, 1917.

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EXPLANATION OF PLATE.

Magnification at which drawings were made, × 3900. Reproduced here at × 2600. Small arabic numerals indicate the autosomes in the order of their size, from smallest to largest. In spermatogonia there are two of each size. The sex chromosome is indicated by an *x*. The numeral preceding the *x* indicates that the sex chromosome in size occurs between the second and third autosomes.

PLATE I.

Nomotettix cristatus Scudder.

FIGS. 1 TO 7. Spermatogonia dividing, metaphase stage.

CHROMOSOMES OF NOMOTETTIX.
Myrtle F. Rayburn.
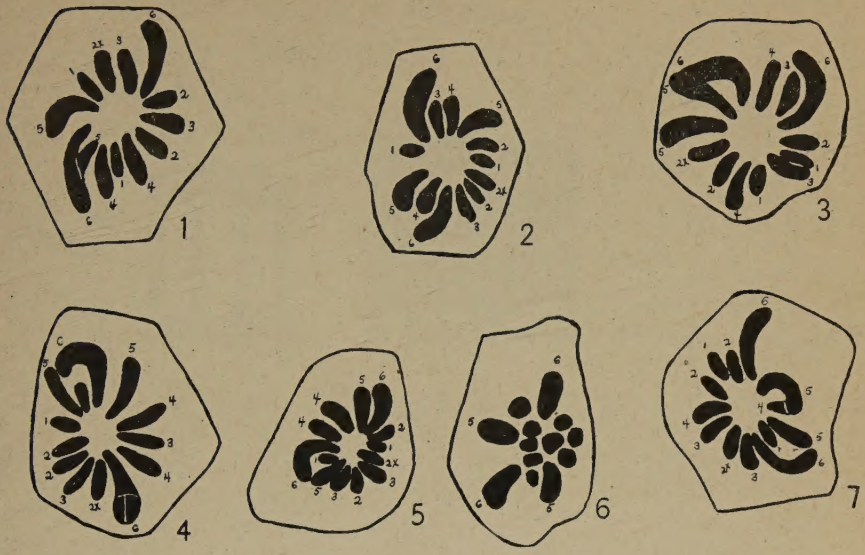
PLATE I.